Madeira on June 27 (NATURE, vol. xxiv. p. 212, with a sequence on p. 237) describing the extraordinary cloud that appeared there on June 26, alarming all the inhabitants, the typically "oldest" of whom declared they had never seen such a cloud as that before? It was, too, in very truth a most remarkable affair; and seemed to me only to admit of full explanation as a peculiar case of the earth answering by escape of its interior electricity to the sun; where, according to my own daily solar diagrams, there had just occurred an outburst of solar spots very nearly over the ends of the solar radii that were then pointing towards the earth.

Weeks passed on without anything to interfere with, or undervalue, that explanation; when lo! on July 26 (the very same day, curiously enough, of the next month) another cloud appeared over Madeira, of just the same peculiar physical character as that of June 26. "Why," were inclined many visitors to ask, "is this kind of cloud, in spite of the asseverations of the 'oldest' inhabitants, no very great rarity after all in this part of the world?" There had been certainly thus two cases of it occurring with a very short interval between them; but nevertheless, I was inclined to respect the assertions of the greybeards; and said, "Something unusual must again have happened in the sun; but as my observatory was dismantled on July 23, and the component parts of it packed up ready for shipment on July 25 and 26, I had not then any knowledge of what it might be." Now, however, see how perfectly Mr. Hennessey's Indian solar photographs fulfil all that was required to make this second Madeira cloud phenomenon an exactly similar cosmical case to that of its mensual predecessor; or to testify that an extraordinary, unusual, most sudden outbreak of solar spots did take place over the very part of the sun's surface turned towards the earth late on July 25, and within twenty-four hours afterwards the earth-electric cloud made its appearance above Madeira, where it was thus noted in my pocket journal:—

"Tuesday, July 26.—During this afternoon there was a great cloud-structure formed to the west, with all the characteristics of smooth-rimmed lenticular strata under strata, and the topmost visible one breaking out into fringes of cirro-cumuli, that marked the still grander cloud of June 26." This one was however very splendid after sunset, and when the red tints thereof had faded from it they were replaced by the richest and purest browns, of the burnt-umber variety, I have ever beheld in the sky. The cloud was vertical over the lower southern slopes, almost the southern sea-shore of Madeira; not over the high peaks of the island, in so far at once pointing to a different origination from Dr. Muirhead's (of Cambuslang) cloud in NATURE, vol. xxiv. p. 237. That cloud was an affair plainly of the cold of a snow-covered mountain-top in Britain, and is just such an ordinary local production as any one can see for a large part of the year on the South African hills round about Table Mountain and Table Bay—whenever the south-east trade-wind blows over that country. For there, day after day, it produces very clumsy-shaped masses of vapour either on, or vertically over, the tops of the hills, according to their respective absolute elevations. But never once, during ten years, did I see any approach in the arrangement of the constituent particles of those clouds to the neat, refined, peculiar shapes of what formed the most conspicuous characteristic of the two successive Madeiran earth-electric clouds of June 26 and July 26. They had each been preceded by as peculiar, as rare, a central outburst of solar activity, and probably required no less for their due manifestation, as well as the performance of their functions in cosmical electric radiations and exchanges.

PIAZZI SMYTH,
Astronomer-Royal for Scotland
15, Royal Terrace, Edinburgh, September 30

American Cretaceous Flora

I HAVE only just read Prof. Newberry's clear and concise account of the American Cretaceous series (NATURE, vol. xxiv. p. 191). I regret that I am still unable to agree with him that the relative ages of American and European Cretaceous beds are satisfactorily correlated. I should not again venture to insist so strongly on what must seem to Dr. Newberry to be but an individual opinion, except that he seems to expect a reply, and I have further some new evidence to bring forward. Of my opinions the one to which he takes most exception seems to be that "no American or European so-called Cretaceous land flora can be proved to be as old as our White Chalk." It is this statement therefore which I must substantiate.

In America the plant-beds of Vancouver's Island contain many Angiosperms, and are said to be of the age of the Gault or Upper Greensand, and the Dakota group, which has yielded one hundred distinct species of Angiosperms, is said to be older than our Chalk. The Colorado group is said to represent not only our Grey and White Chalk, but the Mästricht beds. Even the Laramie group or "Lignite series" is placed in the Cretaceous system. I have unfortunately not the books requisite to re-examine critically the American evidence, and must therefore confine myself to stating that which on this side of the Atlantic tends to show the relative age of the American series to be very considerably overestimated. I would propose, however, to Prof. Newberry an exchange of the more abundant Cretaceous mollusca, in order that they may be compared together; after which I might possibly find myself able to visit some of the American sections. This I should the more like to do, as I happen to be acquainted both with the Cretaceous and Eocene mollusca, and with the floras, of England—the very evidence, in fact, upon which the respective ages of the series is to be decided.

In the first place I am able to assure Prof. Newberry most positively that on plant evidence the Laramie series must be bracketed, if anywhere, with our Middle Eocene. Not only is the facies of the flora identical, but identical species appear in both continents in these series. I cannot yet give a list, but I would particularly point to such highly characteristic species as *Lygodium Kaulfussi*, Heer (syn. *L. neuropteroides*, Lesq.), and *Anemia subcretacea* (Saporta) (syn. *Gymnogramma Haydenii*, Lesq.), which were identified by Lesquereux himself after comparison with actual specimens which I forwarded to him. These are fully described in the Palæontographical Society's publications, which I hope Prof. Newberry will glance through. We have beyond all question, in the first stage of the great "Lignite series," a common line to work from, and the age of this line is, assuredly, according to the plants, that of our Middle Bagshot series. Below our Middle Bagshot there is, in France and England, a vast series of Eocene deposits containing many distinct floras of most dissimilar types, and about which, in many cases, scarcely anything is known. Even at the base of these we are very far from the age of our Chalk, we have still an obscure series of local deposits which to some extent bridge the gap between our Secondary and Tertiary periods. Some of the most noted of these deposits I have recently visited.

The highest, I believe, of these so-called Cretaceous beds in Europe is the coral deposit of Faxoe. Its solitary claim to be considered of Cretaceous age is a *Pleurotomaria!* It has no Cephalopods except *Nautilus* and *Aturia zic-zag*, and not even the persistent *Inoceramus*. Except Pleurotomaria, the mollusca are all more of Eocene than Cretaceous type. *Cypræas* are abundant, and there is a *Mitra*, *Triton*, *Voluta*, *Turbinella*, a *Rostellaria* and *Ampullaria*, &c.

In the underlying "Faxœlaget" the Cretaceous element is reinforced by *Baculites* and *Scaphites*. In the Greensand of Bornholme, *Belemnites* and *Inoceramus* are added; and finally, in the Chalk of Moen, a smooth *Ammonite*, one or more large *Hamites*, and a variety of other Cretaceous types appear. We have thus a clear passage downward into the Cretaceous series; but even the age of the Moen's Chalk is not quite definitely known, for the supposed *Belemnitella*, which apparently fixed its zone, is in reality a *Belemnite*. A few forms, however, seem to link it slightly with the Greensand of Aachen, whose age I shall now consider.

The highest of the Aachenian series is Chalk with flints. In this mollusca are few; but this is of less importance, since the Chalk rests upon Greensand, in which they abound. The fossils are in much the same condition as at Blackdown, and among them are about sixteen apparently Gault and Blackdown species. The greater part of the latter are however carried up into our Grey Chalk, where they cease simply, as far as we know, because the succeeding beds were not fitted to preserve them. These shells are mixed with others, about thirty species, of Tertiary aspect, including *Voluta*, *Murex*, *Turbo*, *Fusus*, *Pyrula*, *Borsonia*, *Bulla*, *Turritella*, *Corbula*, *Tellina*, *Cytherea*, *Lucina*, *Pectunculus*, &c., and *Clavagella*. The presence of *Bellemnitella mucronata* and *B. quadrata*, together with *Baculites*, also point to its being at least younger than the Lower Chalk. Below these are the sands with Dicotyledons. The flora these contain, while mainly unlike that of the Eocene, possesses nevertheless some types of leaves which appear identical with Eocene forms, and is of the highest importance in comparing the American

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Cretaceous series. I need not refer to the Mästricht beds, except to notice that a mixture of Tertiary and Cretaceous types of mollusca is also apparent in them. One circumstance, however, lessens the value of the evidence presented by the mollusca and the flora; we are so little acquainted with either the Gastropods, the Dimyaria, or the plants of the White Chalk age, that it is possible these may have inclined more to Tertiary types than those of the Grey Chalk would lead us to suspect.

I believe that in the American Cretaceous molluscous faunas there is precisely the same mingling of types described above, and if so, they should surely be bracketed together, rather than with our Neocomian Gault, or even Grey Chalk, which present no such mixture and contain few Tertiary types, except in unimportant groups, as Dentalium. Further, we must not overlook the oft-repeated negative arguments that we have no dicotyledonous plants of these ages in Europe, and that *Baculites*, &c., may have survived longer in America than in Europe. The whole series in America forms, so far as I gather, a natural sequence, the age of one part of which, the Laramie, can be fixed as Middle Eocene, and I think, before correlating the remainder with the older Cretaceous beds of Europe, with which neither their fauna nor flora agrees, the position occupied in the American series by the older Eocene, and the transition beds which I have enumerated, should be as far as possible ascertained. The matter is thus still, and must remain for the present, in an unsatisfactory state; but the importance of removing all doubt as to the relative position of those American beds which have yielded such magnificent palæontological data, and of the more typical British strata, is so great that I hope Prof. Newberry will not let the subject drop.

J. S. GARDNER

Gradations between Hermaphroditism and Gynodiœcism

ABORTION of the stamens in some portion of the flowers occurs in different species of the genus Dianthus. *D. superbus* has been shown to be gynodiœcious in my work on "Alpenblumen" (p. 202, Fig. 79). *D. deltoides*, the only species growing near Lippstadt, has lately been examined by myself, and has been found under certain circumstances to become gynomonœcious and gynodiœcious. Of *D. Carthusianorum* among 167 flowering stalks sent me from Thuringia by my brother, Wilhelm Müller, there were two producing female flowers with greatly aborted stamens. *D. deltoides* near Lippstadt offers interesting gradations from hermaphroditism to gynodiœcism. On the border of a meadow of some hundred stems examined by myself, all flowers, without exception, proved proterandrous, with normal development of anthers and stigmas. In the grass-grown slope of a sandy hill ("die Weinberge") likewise all stems produce proterandrous flowers, but on many stems the stamens, although emerging above the petals before the development of the styles and stigmas, bear diminished whitish anthers not opening at all, and containing only some shrivelled pollen grains. Lastly, in a barren sabulous locality ("Schützenplatz") many of the stems produce female flowers, with stamens aborted in the same degree as shown in *D. superbus* ("Alpenblumen," Fig. 79 D), and not unfrequently such female flowers and proterandrous hermaphrodite ones are found on the same stem.

Lippstadt HERMANN MÜLLER

Red Stars

DR. DOBERCK, who has paid particular attention to colour in his observations of Doubles, has kindly sent me the following list of red stars found by him in 1880. The first column gives the number, and the second and third the positions (for 1855) in the B.D. :—

No.	α		δ		Colour.	Date in 1880.
	h.	m.	°	′		
+ 4°·877	5	7	4	59	Red	Jan. 30
*	3	12	±64		Glowing red	Feb. 8
5·1790	7	40	5	46	Ruddy	,, 14
20·1775	7	13	20	42	Pale red	,, 14
22·1198	6	1	22	13	Pale red	,, 14
26·2250	11	37	26	2	Red	March 8
33·4456	22	6	33	53	Red, but very pale	Sept. 10
20·5386	23	45	20	51	Pale red	,, 10

Dr. Doberck remarks that the two stars on both sides of η *Draconis* are pale red; and in *Coma Ber.* and south of it are several ruddy stars.

J. BIRMINGHAM

Millbrook, Tuam, September 18

Bombay Rainfall and Nile Floods

IN looking over data of the rainfall at Bombay and comparing them with the ebb and flow of the Nile for the corresponding years from 1849 to 1880 inclusive, I was so struck with the similarity, almost identity, of magnitudes, that I have been led to copy them out, and perhaps you may consider them worthy of publication in your most valuable journal. Within a trifling fraction the whole of the annual rainfall at Bombay happens in the months of June, July, August, and September. Very rarely a little falls in May, perhaps a little more frequently, some in October, but these small quantities but slightly augment the sum total. They are included in the four months' totals in the following table :—

Year.	Rainfall of June and July in Bombay.	Ditto June, July, and August in Bombay.	Ditto June, July, August, and September in Bombay.	Variation from mean atmospheric pressure.	Lowest ebb of the Nile.	Highest flood of the Nile.	Wolf's sun-spots.
	inches.					feet.	
1849	74·5	88·16	118·88	–·011	1·64	22·31	95·4
1850	36·5	43·11	51·15	–·001	1·64	18·47	69·8
1851	77·7	101·3	106·14	–·013	1·8	23·13	63·2
1852	49·59	60·25	75·46	–·004	2·59	16·73	52·7
1853	52·71	61·27	69·65	+·005	·9	23·01	38·5
1854	55·23	74·43	89·79	–·005	1·8	22·81	21·0
1855	24·98	28·13	35·10	+·015	2·85	16·5	7·7
1856	52·40	62·93	71·08	–·003	1·3	22·81	5·1
1857	38·92	60·93	79·23	–·001	1·42	18·7	22·9
1858	37·92	49·37	61·9	+·003	·32	19·52	56·2
1859	59·86	75·57	81·84	+·003	·29	19·65	90·3
1860	57·69	66·88	74·65	–·003	·08	23·42	94·8
1861	66·43	102·95	106·08	–·012	1·8	23·32	77·7
1862	38·35	62·0	76·56	–·026	1·8	16·53	61·0
1863	58·33	71·8	80·33	–·017	4·13	21·78	45·4
1864	39·37	51·39	56·60	+·023	4·59	14·43	45·2
1865	30·6	69·61	73·46	+·002	3·11	18·47	31·4
1866	64·63	88·5	92·39	+·013	2·54	23·2	14·7
1867	44·93	62·06	73·57	+·015	2·29	19·3	8·8
1868	47·83	71·78	78·43	+·027	2·16	17·1	36·8
1869	58·49	87·2	115·39	+·005	1·57	23·01	78·6
1870	53·39	64·48	81·06	–·012	1·88	22·81	131·8
1871	30·37	39·33	47·2	–·004	2·29	21·98	113·8
1872	60·59	71·21	67·61	–·014	1·23	22·7	99·7
1873	38·69	75·61	87·42	+·002	1·64	19·35	67·7
1874	67·54	78·78	93·56	+·001	·98	25·82	43·1
1875	42·79	58·70	88·08	·0	1·31	21·8	18·9
1876	40·87	52·81	58·93	+·007	–1·88	21·37	
1877	51·99	55·9	70·96	+·037	–1·96	16·8	
1878	73·73	95·63	123·1	–·011	–·72	26·18	
1879	36·95	66·22	73·41			25·03	
1880	38·79	43·55	71·23			21·45	

The floods of the Nile are mainly caused by the heavy rains which descend upon the high tablelands of Abyssinia, a range of mountains on the opposite side of the Indian Ocean to that of the Ghauts, but parallel to them and under the same latitudes. The inference to be drawn is obvious. The great south-west monsoon which sweeps over the Indian Ocean in the summer months produces a like effect in both cases, inducing fertility and plenty, alike on the plains of the Concan of India and the Delta of Egypt. It may be mentioned that the lowest ebb of the Nile always happens in June, and the highest flood about the end of September and the beginning of October. I have included in the table a column showing the variations of the mean barometrical pressure, and a column giving Wolf's observation of sun-spots, taken from NATURE, vol. xxi. pp. 477–82.

MORGAN BRIERLEY

Port Said, September 8

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* Dr. Doberck does not give the number of this star, but it seems to be, probably, 64°·301.

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